

1. A process for curing a dielectric material on a substrate comprising:
  - (a) applying to a surface of said substrate a dielectric material; and
  - (b) exposing said dielectric material to electron beam radiationunder conditions sufficient to cure the dielectric material into a film  
5 possessing desired characteristics.
2. The process of claim 2 wherein said dielectric material is comprised of silicates, phosphosilicates, siloxanes, phosphosiloxanes or mixtures thereof.
3. The process of claim 2 wherein said dielectric material is comprised  
10 of, before exposure to said electron beam radiation, a siloxane having, based upon the total weight of said siloxane, of from about 2% to about 90% of organic groups comprising alkyl groups having from about 1 to about 10 carbons, aromatic groups having from about 4 to about 10 carbons, aliphatic groups having from about 4 to about 10 carbons, or mixtures thereof.
- 15 4. The process of claim 2 wherein said dielectric material is comprised of, based upon the total weight of said dielectric material, from about 0 % to about 10 % phosphorus.
5. The process of claim 1 wherein said dielectric material is applied to said substrate via spin-coating.
- 20 6. The process of claim 1 wherein said film has a thickness of from about 500 Å to about 20000 Å.
7. The process of claim 1 wherein said dielectric material is cured at a temperature of from about 25 °C to about 400 °C.
8. The process of claim 1 wherein said dielectric material is cured at a  
25 pressure of from about 10 mtorr to about 200 mtorr.
9. The process of claim 1 wherein said substrate is preheated with a temperature of from about 50 °C to about 250 °C before said dielectric material is exposed to electron beam radiation.
10. The process of claim 1 wherein said substrate is exposed to  
30 electron beam radiation in the presence of a gas selected from the group consisting of oxygen, argon, nitrogen, helium and mixtures thereof.
11. A film produced according to the process of claim 1.

12. A substrate coated with at least one layer of the film of claim 1.

13. A microelectronic device containing the substrate of claim 12.

14. A process for annealing a substrate coated with a chemical vapor deposit material comprising:

- 5           a)     applying to the surface of the substrate the chemical vapor deposit material; and
- b)     exposing the chemical vapor deposit material to electron beam radiation under conditions sufficient to anneal the chemical vapor deposit material into a film possessing desired characteristics.

10           15. The process of claim 14 wherein said chemical vapor deposit material is comprised of plasma-enhanced tetra-ethyl ortho silicate, silane based oxide, boron-phosphosilicate glass, phosphosilicate glass, nitride, anhydride film, oxynitride, borophospho glass from tetraethyl orthosilane, or mixtures thereof.

15           16. The process of claim 14 wherein said chemical vapor deposit material is a silane-based oxide.

             17. The process of claim 14 wherein said chemical vapor deposit material is applied to said substrate in the presence of a gas comprising a mixture of tetra-ethyl ortho silicate and oxygen or oxygen, silane and  
20   optionally diborane, phosphine, and nitrous oxide.

             18. The process of claim 14 wherein said chemical vapor deposit material is applied to said substrate via spin-coating.

             19. The process of claim 14 wherein said film has a thickness of from about 500 Å to about 20000Å.

25           20. The process of claim 14 wherein said chemical vapor deposit material is annealed at a temperature of from about 25 °C to about 400 °C.

             21. The process of claim 14 wherein said chemical vapor deposit material is annealed at a pressure of from about 10 mtorr to about 200 mtorr.

22. The process of claim 14 wherein said substrate is preheated to a temperature of from about 50 °C to about 250 °C before exposure to electron beam radiation.

23. The process of claim 14 wherein said substrate is exposed to  
5 electron beam radiation in the presence of a gas selected from the group consisting of oxygen, argon, nitrogen, helium and mixtures thereof.

24. A film produced according to the process of claim 14.

25. A substrate coated with at least one layer of the film of claim 24.

26. A microelectronic device containing the substrate of claim 24.

10 27. A process for growing ultra-thin film oxides or nitrides on a substrate comprising:

(a) exposing a surface of the substrate to electron beam radiation in the presence of a material in a gaseous state and under conditions sufficient to ionize the material and promote an oxidization or nitridation  
15 reaction on the surface of the substrate.

28. The process of claim 27 wherein said substrate is comprised of gallium arsenide or silicon.

29. The process of claim 28 wherein said substrate is comprised of crystalline silicon, polysilicon, amorphous silicon, epitaxial silicon, or silicon  
20 dioxide.

30. The process of claim 27 wherein said material is comprised of oxygen, ammonia, nitrogen, nitrous oxide, reaction products or mixtures thereof in the form of a gas, a sublimed solid or a vaporized liquid.

31. The process of claim 27 wherein said oxides or nitrides are grown  
25 on said substrate simultaneously while said substrate is exposed to electron beam radiation.

32. The process of claim 27 wherein said ultra-thin film oxides or nitrides have a thickness of from about 10 Å to about 1000 Å.

33. The process of claim 27 wherein said material is ionized at a  
30 temperature of from about 25 °C to about 400 °C.

34. The process of claim 27 wherein said material is ionized at a pressure of from about 10 mtorr to about 200 mtorr.

35. The process of claim 27 wherein said substrate is preheated to a temperature of from about 50 °C to about 250 °C before exposure to electron beam radiation.

5 36. An ultra-thin film oxide or nitride produced according to the process of claim 27.

37. A substrate coated with at least one layer of the film of claim 36.

38. A microelectronic device containing the substrate of claim 37.

39. A process for reducing the dielectric constant in substrates coated with a dielectric material comprised of exposing said material to electron  
10 beam radiation under conditions sufficient to cure said material.

40. A process for reducing the dielectric constant in substrates coated with a chemical vapor deposit material comprised of exposing said material to electron beam radiation under conditions sufficient to cure said material.

41. A microelectronic device containing a substrate coated with a film  
15 which was exposed to electron beam radiation, wherein the dielectric constant of said electron-beam processed film is less than about 3.

42. The process of claim 1 wherein said dielectric material is exposed to electron beam radiation for about 2 minutes to about 45 minutes.

43. The process of claim 1 wherein said substrate is a silicon wafer.

20 44. The process of claim 14 wherein said substrate is a silicon wafer.

45. The process of claim 27 wherein said substrate is a silicon wafer.